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DIGEST OF TRENDS

IN THE UNITED STATES

TELECOMMUNICATIONS INDUSTRY

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TABLE OF CONTENTS

Page

I INTRODUCTION 1

II THE FCC'S POLICY MAKING ACTIVITIES 2

III THE AT&T REORGANIZATION 15

IV LOCAL NETWORK VERSUS PBX TECHNOLOGY 19

V KEY STANDARDS DEVELOPMENTS 22

VI RADIO AS A LOCAL TRANSMISSION MEDIA 28

VII NEW ELECTRONIC MAIL SERVICES 31

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I INTRODUCTION

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- This digest, produced by INPUT for Agence De L'Informatique, reviews trends in the United States telecommunications industry.

- Telecommunications was selected because of the rapid growth and the rapid rate of change occurring in technology, in government regulation, and in the competitive industry structure.

- Six major topics were selected for analysis:

  - The FCC's policy making activities.

  - The AT&T reorganization.

  - Local network versus PBX technologies.

  - Key standards developments.

  - Radio as a local transmission media.

  - New electronic mail services.

II THE FCC'S POLICY MAKING ACTIVITIES

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I. A REVIEW OF ITS MAJOR ACTIVITIES

- An important area of activity regarding common carrier matters at the FCC is its attempts to change the structure of the communication industry. Important proceedings of the last decade are as follows:

  - The 1968 Carterfone decision, which required that telephone companies permit customer-owned equipment to be interconnected with the telephone system, and the subsequent registration program that was finalized in 1976 and approved by the court in 1977.

  - The 1969 MCI case, the Specialized Carrier decision that followed, and the FCC's attempts to reject MCI's Execunet service in which it was overruled by the Appeals Court in 1977 and 1978.

  - Computer Inquiry I, closed in 1971, which barred AT&T from providing data processing services as regulated offerings and which, in conjunction with the terms of AT&T's 1956 consent decree that barred unregulated activities, completely blocking it from the field.

  - The Domestic Satellite Inquiry, which opened the domestic satellite field to competition and permitted it development time.

  - The sharing and resale cases which appears to have become the tool through which discriminations in private line charges is finally being eliminated.

  - Efforts to establish a new system of accounting standards so as to improve control of industry pricing practices.

- Efforts to revise the procedures for settlements between AT&T Long Lines and operating telephone companies.

- Revision of communication policy as to competition between the international record carriers and AT&T and the relationship of the international carriers to Western Union.

- Attempts to open areas of communication to competition through easing rules regarding entry and regulation of small non-dominant carriers and to protect small competitors through continued regulation of dominant carriers.

- Computer Inquiry II which, if not reversed in one or several of its holdings, will permit AT&T to provide communications-related data processing services and terminal products through a separate unregulated subsidiary and require it to detariff all terminal equipment, including telephone handsets.

- The overall thrust of these proceedings has been:

  - To establish a means of controlling the pricing of communication services so as to keep the large carriers' rates low and also to protect small vulnerable carriers in their efforts to develop innovative services. Specific actions of this kind are discussed in the previous section that is concerned with the FCC's ratemaking activities.

  - To open the provision of some communication services to competition within an overall framework of regulation through continuing formal regulation of large dominant carriers and easing the rules governing the entry and conduct of small carriers.

  - To permit AT&T to enter the market for communications services and terminal products that employ computers and data processing as enhancements. As noted above, it has been barred from these market

  under the joint effect of the Computer/Communications Inquiry (Computer I) and the 1956 consent decree.

- The FCC's important activities in the last two areas are described in this section. Steps taken to inject competition into the provision of international communication services are also discussed.

2. SPECIALIZED CARRIER SERVICES

- Commission members appear to have been lukewarm over opening the long-haul dedicated channel market to specialized carriers at the time the policy establishing the industry was developed in the late 1960's and early 1970's. The push for the policy apparently came from the FCC's staff; the vote on the original MCI application was 4 to 3, with the chairman strongly dissenting to the action. Also, the Commission subsequently permitted AT&T to restructure its private line service so as to provide greater competition to the specialized carriers (see the discussion on HiLo/MPL service).

- The Commission's attitude towards competition in the industry has changed substantially. However, the scope of products that Specialized Carriers can provide was completely opened without its having any ability to control the matter as a result of litigation with MCI over its Execunet service.

  - MCI attempted to expand its product line by filing tariff provisions in 1974 which enabled it to market a public metered switched telephone service. Its intentions were not apparent from the tariff, and the Commission's concurrence in offering the service was not requested.

  - The Commission reacted vigorously. However, its all-out attempts to stop MCI failed when the Appeals Court held in 1977 that the Commission must first determine that there is a public need for limiting the kind of services that can be provided by a carrier before it can impose any restrictions.

- The Commission then attempted to recover the ground lost in Execunet by undertaking an investigation of basic long haul telephone services (e.g., MTS, WATS) to determine the arrangement that is appropriate to the industry (e.g., competition versus monopoly). Southern Pacific Communications, ITT and Western Union have been offering services of this kind while the investigation has been underway.

- At MCI's request, it also undertook an investigation to determine whether resale and sharing of MTS and WATS should be permitted.

- Specialized carriers must depend upon telephone companies to obtain access to local markets. States have jurisdiction over local communication. Many states did not agree with the policy set in the Carterfone and Specialized Carrier cases, and the telephone companies preferred to have states maintain jurisdiction over terminals and access facilities because they would receive more favorable treatment.

- However, the FCC was monitoring the local facility problems and acted as follows:

    - It ruled that provision of access facilities is also a matter of federal jurisdiction and required that AT&T file tariffs covering access facilities with it. It then undertook an investigation of the reasonableness of those tariffs.

    - It encouraged negotiations between the specialized carriers and telephone companies under which the specialized carriers agreed to pay a fee for using the local telephone system to reach their telephone customers. The fee is intended to offset the loss of the subsidy that local companies would have gotten if the specialized carrier traffic had been handled by AT&T. The rates negotiated by the various carriers were than approved by the Commission. They are viewed as temporary.

- The position that AT&T took in the MTS/WATS inquiry is a very improtant and significant change from what was to be expected on the basis of its past actions, and essentially mooted the investigation. In its comments to the commission in March 1980 it took the following stance:

  - That the basic question in the inquiry, whether telephone service should be a monopoly or opened to competition, had already been decided by the Execunet proceeding.

  - That new suppliers should be permitted to introduce and discontinue telephone services, including MTS/WATS-like services, without regulatory restriction.

  - That resale of all interstate services should be permitted.

  - And that improved access arrangements and access charges should be provided to enable carriers to develop and offer competitive MTS/WATS-like services.

- The taking of these positions in this very important proceeding may indicate that AT&T will now cooperate with the FCC in changing the industry along the lines discussed in the sections that follow. One reason for its change of heart may be that it now feels it will gain more through conciliatory actions than it achieved in the past. It may be willing to accept competition in its basic communication market (telephone service) with the hope that it will be allowed to participate in emerging markets that employ computer technology.

- The Commission ended that MTS/WATS market structure inquiry in April and initiated an investigation for the purpose of establishing a general solution to the problem of access charges for local exchange facilities. A long proceeding will probably follow. The long-haul telephone market is now formally treated as being competitive.

- In 1978, Xerox petitioned the FCC to allocate frequencies for use in wideband local distribution as an alternative to reliance upon the telephone system. A rulemaking procedure was undertaken the next year. The outlook appears favorable, but no decision has been reached.

3. BASIC AND ENHANCED SERVICE CARRIERS

- Indications that the FCC was beginning to visualize a segregation of carriers into two levels first appeared in the Shared Use/Resale decision of 1976. It was clear that the the FCC's goal was to achieve an industry structure in which AT&T functions as a wholesale carrier and supplies transmission facilities to other carriers who add functions such as processing and storage and then market a packaged service.

- The 1971 computer/communications decision (Computer Inquiry I) prohibited the provision of data processing services as tariff offerings and required that carriers marketing such services provide them through a separate subsidiary.

- As has been noted, the practical effect of the 1971 Computer I decision, when joined with the 1956 consent decree, was to bar AT&T from providing data processing services. A change in attitude towards this limitation became apparent following AT&T's attempt to tariff the Teletype Corporation's 40/4 CRT terminal, which contained computer features, in late 1975. The FCC staff rejected the tariff under Computer I. AT&T appealed the decision to the full Commission. It held that the device was a communications and not a data processing service and not subject to Computer I, and it accepted the tariff. The Commission then reopened the computer inquiry citing a "blurring" of the distinction between data processing and communications as a result of technological advances. The reopened investigation is called "Computer Inquiry II."

- In May 1979, the Commission issued a "tentative decision" in Computer II which contained the following elements:

- The product spectrum was divided into two sectors: simple "transducer type" equipment such as modems, voice telephones, and simple switches, which would continue to be supplied as part of telephone service; and anything more than that, such as intelligent terminals, augmented electronic private branch exchanges, or answering devices, would be supplied competitively and not by common carriers. A communications company supplying augmented terminal equipment would be required to do so through a separate subsidiary.

- The service spectrum was divided into three sectors: basic voice services, which were to remain regulated, basic non-voice services, which included plain transmission offerings such as AT&T's Dataphone Digital Service and were also to remain regulated, and "enhanced" non-voice services, which were services employing data processing to augment basic functions. Enhanced services were required to be supplied through a separate subsidiary as unregulated offerings.

- It was clearly contemplated by the Commission that AT&T would be permitted to provide enhanced communications services and products. This could violate the decree because such services would not be provided as tariffed products:

  - As stated earlier, the 1956 consent decree, which is of the nature of a contract between AT&T and the Department of Justice, provides that AT&T and its affiliated companies can not engage in any business other than furnishing tariffed common carrier communication services.

  - The decree contains an exception to the above which has now become important: AT&T is allowed to provide untariffed services that are "incidental to the furnishing ... of common carrier communication services."

  - The FCC proposed to solve the problem of the consent decree by having the Commission determine whether an enhanced product or service is "incidental" under the decree to the providing of a tariffed communications service.

  - It also attempted to avoid a conflict by arguing that the consent decree defines regulated services as those for which the prices are subject to regulatory scrutiny, and that the term "subject to scrutiny" does not require actual regulation only the power to regulate. It contends that it will maintain scrutiny of communication companies' enhanced services even though it does not regulate them.

- The tentative decision in Computer II was only a statement of principles. The final decision, reached in April 1980, is now law. It changes the principles of the tentative decision in three respects:

  - It requires that all terminal products, those of the "transducer type" such as handsets as well as enhanced, be provided as competitive offerings and not as tariffed services. (Discussed next.)

  - The distinction between basic voice and basic non-voice was not retained.

  - Only "dominant" carriers, which it defines as AT&T and GTE, are required to provide enhanced services and terminal equipment through separate subsidiaries. This change eases the requirement upon smaller carriers such as Western Union, who previously had to market data processing services, as defined under Computer I, through separate subsidiaries.

- The final decision in Computer II requires that existing enhanced services be detariffed. It also requires that the telephone companies detariff all customer terminals in two years. The FCC has already rejected applications for tariffing two new services because they appear to fall within the enhanced category.

- The Computer II decision, if it stands, would, of course, bring about fundamental changes in the structure of the communications industry, particularly with respect to the implementation of services employing the new technologies such as microprocessors. The appeal process has already started. The decision could be overturned on at least four possible grounds:

  - That there is inadequate justification for the substantitive aspects of the ruling. As discussed in the section dealing with the Commission's powers the court seldom substitutes its own judgement regarding substantive policy for the Commission's so long as the judgement was reached on reasonable grounds, and a reversal on this basis seems unlikely.

  - On technical legal grounds such as the existence of a defect in the Commission's procedure in reaching the decision. A reversal for this reason could occur, as happened in Execunet. However, the effect of a decision of this kind would probably just be to send the Commission back to the drawing boards; it would result in delay but not reverse the general course of policy. Several Commissioners did criticize aspects of the opinion in dissenting comments, but the vote was 5 to 2.

  - That the ruling conflicts with the provisions of the 1956 AT&T consent decree, and that the consent decree is controlling.

  - That the FCC can not refrain from a statutory duty to regulate.

- As just discussed, the Commission justifies its ruling regarding the provision of untariffed services upon an interpretation of the term "incidental to" that

extends to terminal equipment and enhanced communication services, as opposed to clearly secondary services such as directories. The Department of Justice has made it clear that it does not accept this definition. It has taken the position that the FCC has no legal authority to interpret the decree and has stated that it will disregard the ruling in exercising its discretion as to enforcing the decree in the future.

- Its position, if maintained, could lead to the decision's being overturned by a court. However, it is observed that:
  - The Justice Department's positions have often been short-sighted and at odds with FCC policy and court decisions in communications matters. For example, its position in the 1977 Telpak appeal was in favor of continuing the service.
  - The provision of the decree at issue is in fact anti-competitive because it bars AT&T from large business areas.

4. INTERCONNECTION AND THE PROVISION OF CUSTOMER PREMISES EQUIPMENT

- Policy regarding the use of customer-provided equipment on the communication network was fixed in 1976 when the FCC adopted the terminal equipment registration program that permitted any equipment meeting standards to be used on the network. This program was reviewed by the Appeals Court and upheld in 1977.

- As just noted, in its recent decision, the FCC held that terminal equipment markets should be completely opened to competition and ruled that all carriers must detariff such equipment and that AT&T and GTE can provide it only through an unregulated subsidiary.

- One possible ground for reversal of Computer II, not covered in the earlier discussion, is that terminal equipment markets fall within state and not

federal jurisdiction. While there were conflicting opinions regarding jurisdictional matters in prior court cases, this issue appears to have been settled in the 1977 Appeals Court decision regarding the registration program. The Computer II decision is therefore unlikely to be overturned on this ground.

- The FCC excluded over-voltage protection equipment, inside wiring, coin operated telephones and multiplexing equipment from the reach of Computer II. Regulation of premises wiring therefore remains a matter of state jurisdiction. The New York Public Utilities commission ruled in January 1980 that customers can own their own inside wiring. Staff members of the state regulatory commissioners association (NARUC) recently recommended that all states follow the lead of New York.

5. REMOVING PROCEDURAL REGULATORY REQUIREMENTS FOR SMALL CARRIERS

- The FCC has opened interstate telecommunications markets to competition over the last decade. The traditional regulatory tools for controlling tariffs and facility expansion have been applied to the new carriers despite the fact that most of them are small and have limited resources, causing administrative delay and added cost and exposing some of their proposed actions to the risks of failure associated with legal procedures.

- A rulemaking inquiry is underway at the FCC to ease the burden of these regulatory procedures upon some carriers, and it is now reaching resolution. Elements of the approach that will be employed are believed to be as follows:

    - Carriers will be categorized as "dominant" or "non-dominant":

        - Dominant carriers will be defined as those having sufficient market power in some important respect that they are essentially immune from competitive control

  - Non-dominant carriers are those who are subject to effective competition in their regulated market.

- Those who are treated as dominant are:

  - AT&T and all other telephone companies because of their control over local facilities.

  - Western Union with respect to its Telex and TWX record message services.

  - The domestic satellite carriers, which are Western Union and RCA, because of the current shortage of video transmission satellite facilities.

- Those to be treated as non-dominant include:

  - Terrestrial specialized carriers such as MCI, Southern Pacific Communications and U.S. Transmission (an ITT subsidiary).

  - Resale carriers, of which there is reported to be 17.

  - American Satellite and SBS, since they do not offer or plan to offer video transmission.

- Specific procedural requirements eased for non-dominant carriers will probably include the following:

  - Economic support data (e.g., market and cost data) will not be required with the filing of tariffs. This data is now required under section 61.38 of the FCC's rules.

  - The period for which tariff filings are suspended would be reduced from 90 days to 14.

  - Circumstances under which approval must be obtained to construct or expand facilities would be substantially reduced.

- It is quite likely that the Commission will adopt these changes in the near future.

III THE AT&T REORGANIZATION

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- In response to the Computer Inquiry II decision by the FCC and pending legislation on the House and Senate AT&T announced a reorganization in August of this year. The latent organizational separation into "CORE" and "Fully Separate Subsidiary" (FSS), headed by William Ellinghaus and James Olsen respectively, signals a major commitment on Bell's part to take a forceful role in its ultimate destiny.

  - The "CORE" organization will be built around the operating company/Long Lines Network Complex and will operate in a tariffed environment. CORE will maintain its own sales force which will offer transmission services to users and resale vendors. Transmission manufacturing facilities of Western Electric and the Bell Telephone Laboratories will probably remain in CORE.

  - The "Fully Separate Subsidiary" will provide terminal or on premise equipment on a predominantly lease basis. The FSS will in all likelihood be vertically integrated with separate profit centers of business, residence, manufacturing and administrative. Those portions of Western Electric which manufacture terminals, or on premise equipment will be moved over to the FSS. A portion of Bell Labs will also be moved to the FSS with the likely exception of basic research.

- Major issues include the degree of vertical integration of the two entities. Reasonable constraints will have to be exerted on Bell to prohibit massive capital infusions and market penetration by the FSS as an OEM. Other likely restrictions include a requirement to "final assemble", produce subassemblies and manufacture components for its products.

- Expecting this level of operation by March 1982 is unrealistic (as is this date for functional reorganization). It is most likely that the FSS will phase into a completely vertical organization performing final assembly on day one with subassemblies produced two years later and components a further two years down the road.

- Look for Bell to maneuver "basic research" into a contract mode, thus avoiding the break-up of Bell Labs. A key issue in the "basic research" decision is whether or not this research could remain proprietary to the FSS. AT&T will appeal that Bell Labs is a valuable national resource and that fragmentation would produce substantial negative consequences.

- The various planning efforts being conducted at AT&T have produced tenous results in terms of viable plans yet have exposed some significant immediate problems.

  - The Bell System could well be over employed by 200 to 300 thousand people, many of whom will be unable to function in a newer, fast-paced mode of operation. The next two to three years will see multiple plans geared for staff reduction including early retirement incentives and outplacement programs. It should be noted that many highly qualified individuals will take advantage of these programs only to re-emerge as key individuals in organizations competing with Bell.

  - The enhanced services definition will provide some difficulties since AT&T under the pre-Computer Inquiry II decision had progressed well down the road to enhanced offerings such as ACS and Custom Calling II. Assuming a reasonable position on the part of the regulators, exceptions will be made; but how much delay will be induced in this traditionally schizophrenic environment must be questioned.

- The more sinister appeals to the enhanced service provision would be possible delays to imbedded services such as Common Control Inter-office Signaling (CCIS). The CCIS network architecture provides a parallel data network which builds a route for a long distance in its entirety before dedicating any intercity trunking for that call. The initial intent, (which has been verified) was to increase the call handling capacity of the toll network by a factor of approximately 10%. This technology is one of the leading candidates to keep intercity toll costs down by avoiding construction of new circuit routes. However, CCIS inherently provides "calling number identification" which could provide any number of enhanced services (telemarketing response analysis, replacement of call answering service bureaus, etc.).

- Regulatory problems could have severe impact on CCIS and other border line enhanced services by detracting from Bell's willingness to risk resources on services with questionable service dates.

- Another important issue is the positioning of in-house wiring. Since the connecting block is where outside telephone plant enters the customer premise, this point would provide the most logical demarcation between CORE and FSS.

  - As will be seen later, the third generation PABX which would operate over existing in-house wiring plant will be the leading candidate communication architecture for office automation, thus the ownership of in-house wiring will be critical.

  - No one, including Bell, has an accurate capital estimate of the value of the installed in-house plant. This will make transfer to the FSS complex and fraught with competitive and regulatory snarls. If AT&T offers this in-house plant to the FSS they would likely have to offer it on the same terms and conditions to FSS competitors.

- AT&T will also attempt to transfer only reasonably "state of the art" on premise systems to the FSS. It would be undesirable for the FSS to assume primitive technological products such as step-by-step 700 series PABX's with artificially high book values.

  - The current "migration strategy" for on premise systems which calls for the replacement of older products with advanced products then becomes a solid marketing tactic and a keen financial ploy.

IV LOCAL NETWORK VERSUS PBX TECHNOLOGY

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- The major technical development of 1980 was the growth in awareness of new approaches for local and intra building networks.

- The two most significant entries were Xerox Corporation's publication of the Ethernet specification and the announcement of a third generation PABX by Intecom, an Exxon Enterprises company. These two approaches operate with significantly different technologies and philosophies. The lines of debate are beginning to form and it is expected that "loops versus stars" will provide the early '80's corollary of "centralized versus distributed" or "analog versus digital".

- The Ethernet system (a loop approach) operates over a coaxial cable at 3 megabits per second. Connected devices are assigned unique addresses. Transmission is initiated on a contention basis where the sending device examines the high speed coaxial bus for transmission activity prior to sending data. In the event that the bus is active the terminal will wait and try again with the wait interval determined by a randomizing algorithm. This communications control technique is termed Carrier Sense Multiple Access/Collision Detection.

    - CSMA/CD at 3 MBPS, positions Ethernet exclusively for interconnecting digital business machines (word processors, data terminals, host computers, digital facsimile, etc.)

  - The Ethernet specification, published in mid 1980, calls for a transmission speed of 10 MBPS, which significantly enhances its applicability for voice.

- The Intecom System 40 was publicly announced at the International Communications Association Conference in May 1980. The architecture reflects a third generation PABX in several respects.

  - It is a truly non-blocking switch capable of supporting up to 4,000 simultaneous voice and data connections.

  - The System 40 truly integrates voice and data. The voice digitization device is located in the telephone instrument as well as a data interface module which allows data transmission at up to 56 kbps. Each digital instrument is connected to its service controller by 128 kbps full duplex channel operating on traditional twisted pair. Each distributed controller will serve 256 simultaneously active digital instruments. Up to 16 controllers are connected to a central switch by 44 mbps fiber optic or coaxial busses.

  - The Intecom offering employs state of the art technologies such as packet switching, fiber optics and distributed microprocessor based architecture.

- At this point in time the third generation PABX (a star approach) has several advantages over the loop or ring concept.

  - Neither the original Ethernet or the other loop systems such as Mitrenet, Fordnet, NBSnet have the bandwidth necessary to address voice communications. Voice will continue to be the least common denominator for office communication. The current state of the art calls for voice to be digitized at 56,000 bps. Using the most common digital multiplexing scheme (T1) 24 channels can be supported at 1,544 mbps. A 3 mbps Ethernet bus would, then, be saturated by 48

simultaneous voice connections. Since speech is inherently bursty and a channel is typically idle 70% of the time, some form of compression could be employed. At 2:1 compression the Ethernet could support 96 voice connections before saturation, but how this compression could be handled has not been addressed. Other loop systems have even more pronounced problems since they have even lower bandwidth approximately 1 mbps.

- The 10 mbps Ethernet systems has a significantly higher capability for voice.

- Another difficulty with loop networks is that they require the installation of special coaxial cable. The third generation PABX will operate over the in-place twisted pair wires, which support traditional voice telephone systems, and as such the cost of installation for special coaxial systems would be avoided. In some cases the installation of coaxial systems would be impossible due to congestion of in building distribution facilities.

- It is expected that higher throughput loop systems will be announced in the near future which will operate at speeds in the 100 mbps range. This level of capacity will allow voice to be handled effectively and could thus offset the cost of installing a coaxial system.

- At this point it is hard to visualize applications or loads that would exceed the data rates supported by the third generation PABX. Fifty-six kbps (56 kbps) is, after all, 5600 bytes per send or 336,000 bytes per minute at 80% utilization of a synchronous channel, or pretty lofty speed in an environment where on-line systems run at 4800 bps and most of the candidate terminal users type at 3.5 cps. None the less high speed requirements for video at 1.5 mbps and possibly ultra high speed graphics may come to the forefront by the mid-eighties making the high speed loop (100 + mbps) a more attractive alternative.

V KEY STANDARDS DEVELOPMENTS

INPUT

I. OPEN SYSTEM INTERCONNECTION

- Probably the most important topic now in the standards world is Open System Inteconnection (OSI). It is important because it is so all encompassing. The purpose of OSI is to allow any two computers, terminals or "processes" to exchange information according to an agreed upon set of rules or protocols.

- OSI is not just for data. It would work equally well for text, facsimile or even voice. It will work with or without encryption.

- With the increasingly rapid spread of computers, word processors, facsimile machines and telephones, users are being burdened with systems that cannot work with each other and with miles of partially used wire. OSI will provide a method for communicating.

- Vendors will either continue developing their own proprietary methods for interconnecting or agree to conform to the OSI model. As OSI becomes accepted, users will begin to expect demand that vendors conform to the OSI model.

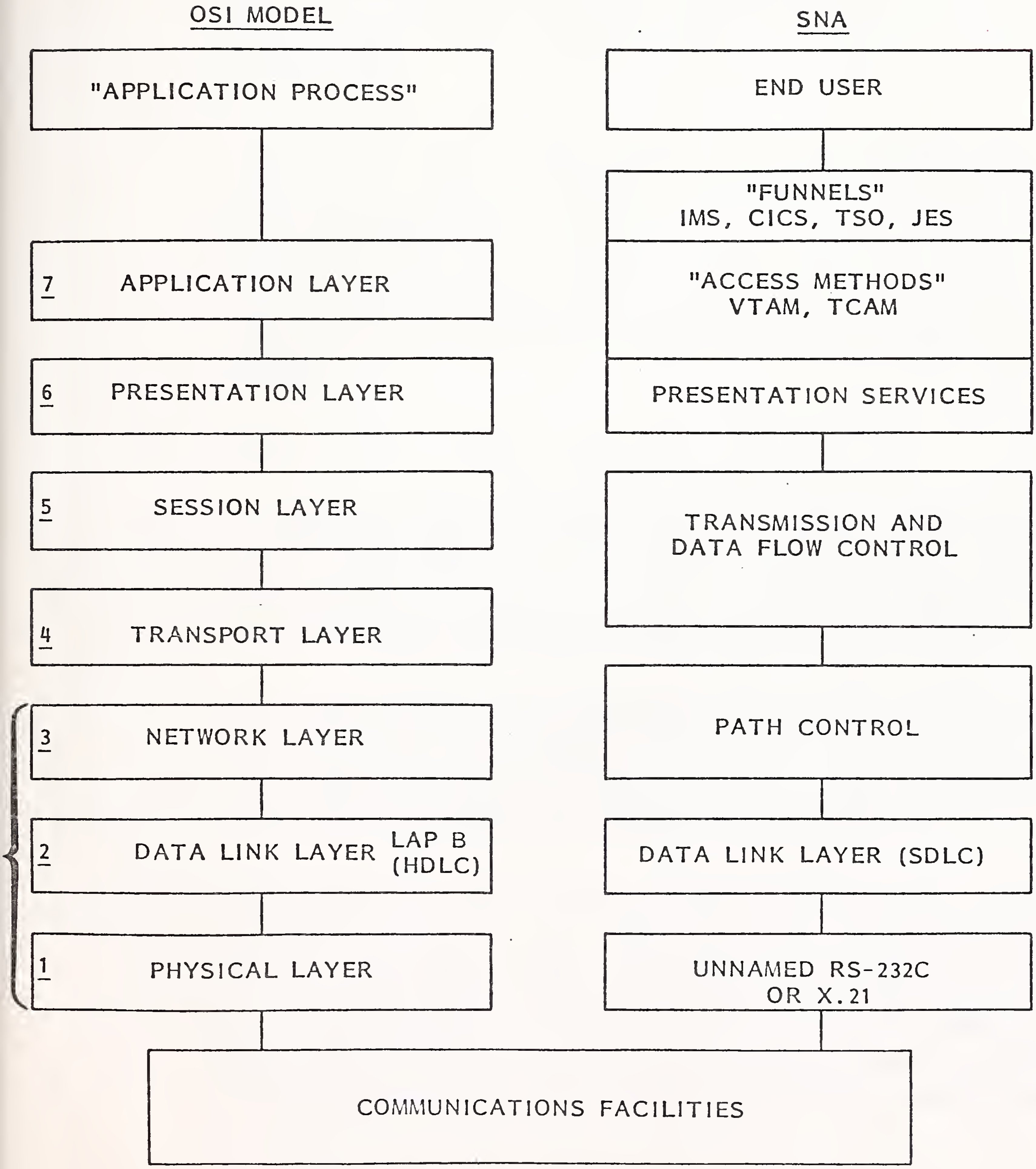
- The major threat to OSI is from computer manufacturers' own methods for interconnections, such as IBM's SNA or Digital's DECNET.

- OSI and SNA both are layered architectures as shown in Exhibit A. But so far, IBM has kept most functions in the host access methods, VTAM or TCAM. In fact, the way current versions of SNA are implemented, the access method includes the presentation, transmission and data flow control as well as the critical portions of path control. The result is that the layers may represent demarcations within the access method code but are not useful for defining user recognizable access points to the communications system.

- IBM is now suggesting to standards making organizations that SNA be used as a model or guide for developing the application layer of OSI. IBM suggests that since SNA is already working, it would save time and effort to use it.

EXHIBIT A

OSI VERSUS SNA LAYERING SCHEMES



Certainly time and effort for IBM if it does not later have to convert its software to the OSI model.

- The first version of the OSI model is expected to be approved at the plenary session of ISO/TC97/SC16 in Berlin in November 1980. It is expected that the model will be refined and extended over the next few years. It is not intended to remain static.

- In this regard, it is interesting to note that the U.S. position is that the OSI specification is a "reference model" for comparison to other standards or specific implementations. Europeans, on the other hand, are already pushing for the OSI model to be a "standard." In this regard, the transport layer, where the application related layers 5, 6 and 7 meet the transmission system as presently being described by ISO/TC97/SC16 is being considered as a CCITT standard.

2. X.25

- A second major area of standards work is the packet network description known as X.25. This standard was rushed to completion for the 1976 CCITT plenary session. At the time it was far from complete. A much revised and improved standard is scheduled to be approved at the plenary this fall.

- At this point, note that the X.25 standard is a CCITT function while OSI is in ISO's realm. Also, the OSI model is concentrating on layers 4, 5, 6 and 7; X.25 is the designated standard for layers 1, 2 and 3. Note, also, that there is already some agreement between ISO and CCITT about layer 4.

- X.25 is being used as the basis for developing public networks in a number of countries, including the U.S. While AT&T has withdrawn its Advance Communication Service (ACS), it is significant that AT&T has chosen to develop an internal network based on X.25. Known as BX.25 within the Bell System, the network is described as a layered implementation including the transport and session layers. Documentation of BX.25 is intended for potential

suppliers to AT&T and states that revisions may be made to maintain conformance with ANSI, ISO, EIA, CCITT standards, or advances in the state of technical arts.

- Several manufacturers of computer and communications systems have chosen X.25 as a basis for network development. With so much X.25 network development, it is reasonable to assume that X.25 capability will be offered by most computer manufacturers by 1985.

- Even IBM offers X.25 gateways to SNA, but they do it for now in France and Canada in a very awkward manner. Rather than substituting X.25 for SNA path control and data link control, the wrap the SNA packet inside an X.25 packet, making for double work at these layers and more packets.

- The reason that IBM is supporting X.25 at all--and may be forced to do so more in the future--is that the private lines that SNA is designed to use may not be available in the future in many countries. Even AT&T may be moving away from private lines to emphasis on an update MTS system and an X.25 compatible data network. In that case, SNA, as now implemented, would not be possible to anyone other than SBS users, or users of other satellite or microwave carriers.

- As leased line services are increased in cost and decreased in availability throughout the world, public packet networks, with the X.25 interface will become the only viable method for implementing a nationwide or worldwide data network without large scale satellite facilities.

3. X.21

- The physical interface between computer/terminal equipment and communications equipment that is most used in the U.S. and throughout the world is RS-232C. This 20 year old standard is in need of replacement or revision. It is limited in the speeds it can handle, the allowable distance between the business machine and the modem and range of its functions. Also, there are several incompatible implementations of this interface.

- The long term solution that is proposed is the X.21 interface, which will allow for high speeds, long cable lengths and a range of control functions impossible with RS-232C.

- X.21, which is the physical interface specified for level I in X.25, is an "intelligent" interface. The connection uses fewer wires and pins than RS232C. Rather than multiple control leads, there is one going to the modem and one going back to the terminal equipment. Codes are used to specify the control functions.

- X.21 is desirable—but converting to it en masse would be expensive. Modems and equipment interfaces would need to be exchanged in a coordinated manner for each end of a circuit.

- Therefore, an intermediate step has been arranged, RS-449. This interface in a modem can provide many of the new functions of the X.21 interface while working with RS-232C equipped terminal equipment. This can be accomplished by changing the plug on the cable or by using an adapter unit. The key point is that no expensive changes will be required in the terminal equipment.

- It is now expected that the evolution to X.21 will require changing the interface logic in the terminal equipment. IBM has already indicated that they plan to supply X.21 interfaces for their products, just as they supply the seldom used DDS now.

- With the growing emphasis on network control and diagnostic capabilities, it is logical to consider using the new interfaces as soon as they are generally available. Rather than having a proliferation of smart modems that only work with the manufacturers network control system, a standardized set of control functions, such as loopback testing, will allow for more flexibility in network development.

4. LOCAL NETWORKS

- Local networks provide one of the greatest opportunities to achieve greater productivity in the office without corespondingly larger costs. The productivity increase will come from the ability to use a wide variety of equipment as required and have it interconnect on a common network. The cost savings will come from not having to string new wire from a central switch or controller each time new equipment is added.

- The key issue with local networks is whether there will be few standards or many. A single standard, used by all, is very unlikely.

- Ethernet, develop by Xerox, is certainly the most well known at this time. The Xerox arrangement with DEC and Intel provides a method of getting many Ethernet users who would not necessarily use Xerox office equipment--but could, very easily, once Ethernet is used in an installation. DEC will provide the gateway to larger computer systems, using DECNET with both X.25 and SNA interfaces. Intel will provide the chip sets (initially, printed circuit boards) for other vendors to use in building products that can use Ethernet.

- There are a large number of competing local networks. Many are one of a kind within a company or university. A few are intended for the marketplace as Ethernet competitors. These include Ungermann-Bass' Net/One, Zilog's Z-Net. Also, there are local nets based on broadband cable television technology from such companies as 3M/Interactive Systems and Sytek/Network Resources.

VI RADIO AS A LOCAL TRANSMISSION MEDIA

VI RADIO AS A LOCAL TRANSMISSION MEDIA

- One of the major long-term bottlenecks anticipated in communication networks is the lack of availability of wideband (1.5 mbps) intracity circuits.

  - Wideband satellite channels from organizations such as Satellite Business Systems and others are expected to alleviate the long distance wide band transmission situation over the next few years.

  - Intra-building facilities such as coaxial cable or computerized PBX systems (see Sections IV and V) can similarly be expected to solve the very short distance transmission problems.

  - Getting information between those facilities is a problem which, to date, has not exposed any obvious solutions.

  - Efficient and high-frequency radio techniques are starting to be seriously addressed as potential solutions to this problem.

- The use of the 10 GHz band as a medium for local data distribution was first publicized by the XTEN proposal of Xerox.

  - Last week the FCC approved the basic Xerox concept, allocating a portion of this band for such use.

  - Up to 15 service vendors can share this band in any given metropolitan area.

- The use of the Multi-point Distribution Service, an omnidirectional microwave transmission system, has been proposed for data transmission.
  - MDS, used primarily for distribution of pay television signals, is primarily a one way broadcast service.
  - The National Telecommunications and Information Agency, supported by a number of data related companies, has suggested the expanded use of this service for data applications. This means primarily the expansion of the bandwidth of the available return channels.
  - Tymnet acquired Microband, the largest of the MDS companies in mid 1980.
- Cellular radio is another technology with local area data transmission potential.
  - Cellular radio, operating in the 800 MHz band, is being developed primarily as an efficient use of bandwidth for mobile radio applications, most of which are voice.
  - Millicom, a company in which IBM has recently invested significant funds, has proposed experiments in the use of cellular radio as a data transmission medium using Millicom terminals.
  - Tymnet is taking a cellular radio approach (at 10 GHz) to the local transmission experiment being implemented in conjunction with Satellite Business Systems, Aetna and M/ACOM in New York and San Francisco.

VII NEW ELECTRONIC MAIL SERVICES

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- A number of new electronic mail services, offering managed message communications between terminals or from terminals to homes and businesses, were introduced during the last year and more are expected in the near future.

- The U.S. Postal Service, which has been tackling the ECOM service for the past three years, finally appears to have a defined direction.

  - The direction, defined for USPS by the Postal Rate Commission, is one in which serving post offices would be equipped with multi-system compatible communication receivers (mini-computers) with high-speed printers. These systems would receive and print messages from user computers and place them in the local mail delivery stream much as the USPS/WU Mailgram system does today.

  - The cost of an ECOM message thus entered would be .26¢ in reasonable size volumes (2,000 messages per batch, 50,000 messages per month.)

  - This price compares with the .15¢ first class letter on the one hand and the $1.10 minimum price Mailgram on the other.

- Tymnet introduced a similar service of its own in early 1980.

  - This service, called Tymegram, receives messages electronically from users into the Tymnet system and prints, envelopes and stamps them in 30 cities around the U.S. and places them in the USPS mail stream in those 30 cities as a first class letter.

  - The Tymegram price ranges from .30¢ to .95¢ with the average being about .35¢ in volumes comparable to those proposed for ECOM.

- Direct terminal-to-terminal services were introduced by Tymnet and by Telenet in 1980.

  - These services, called respectively On-Tyme and Telemail, have been sold successfully as specialized message networks to departments of large companies such as Sales, Accounting and Project Management teams.

- The remote computing service companies have had users implementing mailbox-based electronic mail services on their time sharing computers networks for many years.

  - With the lifting of the apparent constraints imposed by FCC regulation in the Computer Inquiry II, INPUT has learned that a number of those remote computing vendors are about to bring their electronic mail services "out of the closet" in the next few months.

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